al. 2000b, p. 962; Amstrup et al. 2004, p. 675; Durner et al. 2007, pp. 18–19), and it is thought that this preference reflects increased hunting opportunities over more productive waters. Also, tracking studies indicate that few if any bears are year-round residents of the central Arctic Basin, and therefore this relatively unpopulated portion of the Arctic was not designated as an ecoregion.

Sea Ice Environment

As described in detail in the ''Species Biology'' section of this rule, above, polar bears are evolutionarily adapted to life on sea ice (Stirling 1988, p. 24; Amstrup 2003, p. 587). They need sea ice as a platform for hunting, for seasonal movements, for travel to terrestrial denning areas, for resting, and for mating (Stirling and Derocher 1993, p. 241). Moore and Huntington (in press) classify the polar bear as an ''ice-obligate'' species because of its reliance on sea ice as a platform for resting, breeding, and hunting, while Laidre et al. (in press) similarly describe the polar bear as a species that principally relies on annual sea ice over the continental shelf and areas toward the southern edge of sea ice for foraging. Some polar bears use terrestrial habitats seasonally (e.g., for denning or for resting during open water periods). Open water is not considered to be an essential habitat type for polar bears, because life functions such as feeding, reproduction, or resting do not occur in open water. However, open water is a fundamental part of the marine system that supports seal species, the principal prey of polar bears, and seasonally refreezes to form the ice needed by the bears (see ''Open Water Habitat'' section for more information). Further, the open water interface with sea ice is an important habitat used to a great extent by polar bears. In addition, the extent of open water is important because vast areas of open water may limit a bear's ability to access sea ice or land (see ''Open Water Swimming'' section for more detail). Snow cover, both on land and on sea ice, is an important component of polar bear habitat in that it provides insulation and cover for young polar bears and ringed seals in snow dens or lairs (see ''Maternal Denning Habitat'' section for more detail).

Sea Ice Habitat

Overview of Arctic Sea Ice

According to the *Arctic Climate Impact Assessment* (ACIA 2005), approximately two-thirds of the Arctic is ocean, including the Arctic Ocean and its shelf seas plus the Nordic, Labrador, and Bering Seas (ACIA 2005, p. 454). Sea ice is the defining characteristic of the marine Arctic (ACIA 2005, p. 30). The Arctic sea ice environment is highly dynamic and follows annual patterns of expansion and contraction. Sea ice is typically at its maximum extent (the term ''extent'' is formally defined in the ''Observed Changes in Arctic Sea Ice'' section) in March and at its minimum extent in September (Parkinson et al. 1999, p. 20,840). The two primary forms of sea ice are seasonal (or first year) ice and perennial (or multi-year) ice (ACIA 2005, p. 30). Seasonal ice is in its first autumn/winter of growth or first spring/summer of melt (ACIA 2005, p. 30). It has been documented to vary in thickness from a few tenths of a meter near the southern margin of the sea ice to 2.5 m (8.2 ft) in the high Arctic at the end of winter (ACIA 2005, p. 30), with some ice also that is thinner and some limited amount of ice that can be much thicker, especially in areas with ridging (C. Parkinson, NASA, in litt. to the Service, November 2007). If first-year ice survives the summer melt, it becomes multi-year ice. This ice tends to develop a distinctive hummocky appearance through thermal weathering, becoming harder and almost salt-free over several years (ACIA 2005, p. 30). Sea ice near the shore thickens in shallow waters during the winter, and portions become grounded. Such ice is known as shore-fast ice, land-fast ice, or simply fast ice (ACIA 2005, p. 30). Fast ice is found along much of the Siberian coast, the White Sea (an inlet of the Barents Sea), north of Greenland, the Canadian Archipelago, Hudson Bay, and north of Alaska (ACIA 2005, p. 457).

Pack ice consists of seasonal (or first-year) and multi-year ice that is in constant motion caused by winds and currents (USFWS 1995, pp. 7–9). Pack ice is used by polar bears for traveling, feeding, and denning, and it is the primary summer habitat for polar bears, including the Southern Beaufort Sea and Chukchi Sea populations, as first year ice retreats and melts with the onset of spring (see ''Polar Bear-Sea Ice Habitat Relationships'' section for more detail on ice types used by polar bears). Movements of sea ice are related to winds, currents, and seasonal temperature fluctuations that in turn promote its formation and degradation. Ice flow in the Arctic often includes a clockwise circulation of sea ice within the Canada Basin and a transpolar drift stream that carries sea ice from the Siberian shelves to the Barents Sea and Fram Strait.

Sea ice is an important component of the Arctic climate system (ACIA 2005, p. 456). It is an effective insulator between the oceans and the atmosphere. It also strongly reduces the ocean-atmosphere heat exchange and reduces wind stirring of the ocean. In contrast to the dark ocean, pond-free sea ice (i.e., sea ice that has no meltwater ponds on the surface) reflects most of the solar radiation back into space. Together with snow cover, sea ice greatly restricts the penetration of light into the sea, and it also provides a surface for particle and snow deposition (ACIA 2005, p. 456). Its effects can extend far south of the Arctic, perhaps globally, e.g., through impacting deepwater formation that influences global ocean circulation (ACIA 2005, p. 32).

Sea ice is also an important environmental factor in Arctic marine ecosystems. ''Several physical factors combine to make arctic marine systems unique including: a very high proportion of continental shelves and shallow water; a dramatic seasonality and overall low level of sunlight; extremely low water temperatures; presence of extensive areas of multi-year and seasonal sea-ice cover; and a strong influence from freshwater, coming from rivers and ice melt'' (ACIA 2005, p. 454). Ice cover is an important physical characteristic, affecting heat exchange between water and atmosphere, and light penetration to organisms in the water below. It also helps determine the depth of the mixed layer, and provides a biological habitat above, within, and beneath the ice. The marginal ice zone, at the edge of the pack ice, is important for plankton production and plankton-feeding fish (ACIA 2005, p. 456)

Observed Changes in Arctic Sea Ice

Sea ice is the defining physical characteristic of the marine Arctic environment and has a strong seasonal cycle (ACIA 2005, p. 30). There is considerable inter-annual variability both in the maximum and minimum extent of sea ice, but it is typically at its maximum extent in March and minimum extent in September (Parkinson et al. 1999, p. 20, 840). In addition, there are decadal and inter-decadal fluctuations to sea ice extent due to changes in atmospheric pressure patterns and their associated winds, river runoff, and influx of Atlantic and Pacific waters (Gloersen 1995, p. 505; Mysak and Manak 1989, p. 402; Kwok 2000, p. 776; Parkinson 2000b, p. 10; Polyakov et al. 2003, p. 2,080; Rigor et al. 2002, p. 2,660; Zakharov 1994, p. 42). Sea ice ''extent'' is normally defined as the area of the ocean with at least 15 percent ice coverage, and sea ice ''area'' is normally defined as the integral sum of areas actually covered by sea ice